

Express Mail No. EL870248771US
Date of Deposit: December 11, 2001

Attorney Docket No. 18133-089

APPLICATION

FOR

UNITED STATES LETTERS PATENT

SPECIFICATION

TO ALL WHOM IT MAY CONCERN:

Be it known that **Raymond M. Fallon, Jane E. Morgan, Thomas N. Fegan, Jacqueline M. Hayes, all Citizens of Ireland and Edward M. Ives, a U.S. Citizen of West Kingston, R.I.** have an invention entitled **POWER SUPPLY ALARM CONTROL SYSTEM** of which the following description in connection with the accompanying figures is a specification.

TRA 1605149v1

POWER SUPPLY ALARM CONTROL SYSTEM**Field of the Invention**

The present invention relates generally to power supply systems. More 5 specifically, embodiments of the present invention are directed to systems and methods that control an alarm for uninterruptible power supply (UPS) systems.

Background of the Invention

The use of UPS's having battery back-up systems to provide regulated, 10 uninterrupted power for critical and/or sensitive loads, such as computer systems, and other data processing systems is well known. A UPS system can have an audio alarm to provide a user with notification of an occurrence of one or more predetermined power related issues, such as a low or bad UPS battery. For example, a UPS can sound an alarm to notify a user that a UPS battery has a low or insufficient voltage. However, in some 15 circumstances it may be necessary or desirable to have flexible control of the enabling and disabling of the audio alarm.

Although some UPS devices provide dip-switches to allow a user to manually turn-off the alarm, it can be bothersome to manually turn the alarm on and off on a daily or frequent basis.

20 One device, PowerChute Personal Edition, manufactured by the American Power Conversion of W. Kingston, RI, provides to a user an audio notification of a UPS failure.

However, PowerChute doesn't allow a user to flexibly control the alarm other than to enable, disable or mute the alarm.

Summary of the Invention

5 Embodiments of the invention provide methods of controlling the enabling and/or disabling of an audio alarm that indicates an occurrence of a predetermined event of a power supply. In one embodiment of the invention, a method includes programming to enable the audio alarm of the power supply during a first predetermined time period, and programming to disable the audio alarm of the power supply while the power supply is
10 still operational during a second predetermined time period.

In another embodiment, a system for controlling an audio alarm indicates an occurrence of a predetermined event of an uninterruptible power supply (UPS). The system in this embodiment includes means for programming to enable the audio alarm of the UPS during a first predetermined time period, and means for programming to disable through software the audio alarm of the UPS while the UPS is still operational during a
15 second predetermined time period.

In yet another embodiment, a system for controlling an audio alarm indicates an occurrence of a predetermined event of a power supply. In this embodiment, the system includes a power supply having an alarm, and a computer system coupled to the power supply and programmed to: enable the audio alarm of the power supply during a first predetermined time period; and disable the audio alarm of the power supply during a
20 second predetermined time period.

In still yet another embodiment, an article of manufacture includes a computer

usable medium having computer readable program code embodied therein for controlling an audio alarm that indicates an occurrence of a predetermined event of a power supply coupled to a computer system, wherein the computer readable program code includes: instructions for causing the computer system to enable the audio alarm of the power supply during a first predetermined time period; and instructions for causing the computer system to disable the audio alarm of the power supply while the power supply is still operational during a second predetermined time period.

One advantage of embodiments of the invention is that the system is able to automatically enable and disable an audio alarm during specified time periods of the day.

- 10 Thus, a user can designate when an alarm will and will not sound so as not to disturb the user or others at an inconvenient time.

Brief Description of the Drawings

For a better understanding of the present invention, reference is made to the drawings which are incorporated herein by reference and in which:

FIG. 1 is a block diagram of the power supply critical state monitoring system according to the present invention;

FIG. 2 is a flowchart of an exemplary method of monitoring a power supply according to the present invention; and

- 20 FIG. 3 is a flowchart of an exemplary method of monitoring a power supply once
it is determined that the power supply has lost communication with a computer network.

Detailed Description of the Invention

A first embodiment of a system 10 of the present invention will now be described with reference to FIG. 1. The system 10 includes a computer 12 is coupled to a power supply, such as an uninterruptible power supply (UPS) 14. The UPS 14 has an audible alarm 16 and can have a visual indicator 18, such as a light emitting diode (LED). The

5 UPS 14 is coupled to the computer 12 through a communication cable 20 and a power cable 24. The UPS 14 can have a computer interface card 22 for communicating with the computer 12 over cable 20. The computer 12 can have a card or interface in it for communicating with the UPS 14 over cable 20. The UPS 14 typically provides the computer 12 with power over line 24 and will continue to do so if the main power source

10 of the computer is interrupted.

The audio alarm 16 of the UPS 14 is configured to sound if one or more predetermined events occur to the UPS or main power supply of the computer. The predetermined events can include, for example, the computer losing its main power source, a specified age of the UPS 14, a power supply or a battery contained in the UPS,

15 a predetermined remaining runtime of a battery, a failure of the UPS, a power supply or a battery's failure to pass a self diagnostic test, the UPS or power supply being unavailable or the load of the UPS being greater than a predetermined limit.

In one embodiment, the computer including one or more software programs for controlling the audio alarm 16 of the UPS 14, and in addition, firmware is provided in the

20 UPS 14 to enable, disable or mute the audio alarm 16 of the UPS. To control the audio alarm 16, the software program communicates with and controls the firmware of the UPS 14 to enable, disable or mute its audio alarm.

The computer software can have one or more threshold values for a predetermined event if necessary, such as the age or the remaining runtime of a battery. The obtained threshold values are preferably set as default values in the computer software and are changeable such that the default threshold values are user definable. A 5 threshold level may not be necessary for some events, such as for the failure of a battery.

Embodiments of the invention allow a user to automatically enable or disable the audio alarm 16 of the UPS 14 during one or more predetermined time periods. Thus, a user can disable the audio alarm to prevent the alarm from disturbing one or more people. This can be desirable for times such as during the evening when the user is sleeping or 10 during the day if the user does not want to be disturbed.

The UPS 14 can also include a visual indicator 18, such as an LED or a light, to provide an indication that the predetermined event has occurred. The visual indicator can be activated to indicate an event when the audio alarm is disabled or enabled. The visual indicator 18 can be mounted on the UPS or can be provided external to the UPS such as 15 mounted on or near the computer. The visual indicator can turn on or blink during the occurrence of a predetermined event.

In another embodiment of the invention, the system 10 can be configured for the use of two or more different users. A first user can specify that the UPS audio alarm 16 is to be disabled during one or more time periods and the second user can specify one or 20 more different time periods that the audio alarm is disabled. Thus, the system 10 can be configured such that the times the audio alarm 16 is enabled or disabled are flexible according to the desires of one or more users.

FIG. 2 shows a method 50 of controlling an audio alarm 16 for indicating an occurrence of a predetermined event of a power supply, such as a UPS 14, coupled to a computer. At 52, the audio alarm 16 of the power supply is automatically enabled during a first predetermined time period. During this first time period, if one of the 5 predetermined events that would normally sound the alarm occurs, then the alarm will sound as usual to tell a user that the event has occurred. At 54, the audio alarm 16 of the power supply is automatically disabled while the power supply is still operational during a second predetermined time period. During this second time period, if one of the predetermined events occurs, the UPS 14 will not sound the audio alarm and potentially 10 disturb someone. The user can specify the second time period that the alarm 16 is disabled through computer software. The first and second time periods when added together can equal one day, or longer time period such as a week or a shorter time period such as a workday. Additionally, the alarm 16 can be enabled and disabled several times throughout a time period such as a day.

15 FIG. 3 shows a method 60 of controlling an audio alarm 16 for indicating an occurrence of a predetermined event of an uninterruptible power supply 14 (UPS) coupled to a computer. At 62, the audio alarm 16 of the UPS 14 is automatically enabled during a first predetermined time period of a day. At 64, the audio alarm 16 of the UPS 14 is automatically disabled through software while the UPS is still operational during a 20 second predetermined time period of the day. At 66, the audio alarm 16 of the UPS 14 is automatically disabled through software when the computer system is powered off. Because, the computer software disables the alarm in the method 60, it is preferable that

the UPS audio alarm 16 is disabled when the software program is shut down so as not to disturb a user during an undesirable time if a predetermined event occurs.

It should be noted with the methods 50 and 60 that the UPS 14 may have the audio alarm 16 typically enabled and a software program automatically disables the alarm
5 or that the UPS may have the audio alarm typically disabled and a software program automatically enables the alarm.

FIG. 4 shows another method 70 of controlling an audio alarm 16 for indicating an occurrence of a predetermined event of an uninterruptible power supply (UPS) coupled to a computer. The method begins at 72 with the computer running and UPS
10 software program installed and running on the computer 12. At 74, the computer 12 determines if either it or the UPS software program is shutting down. If either the computer 12 or the UPS software program is shutting down, then the UPS audio alarm is disabled so that the alarm will not go off unexpectedly. If both the computer 12 and UPS software program are running, at 78 the UPS program determines if the computer is in a
15 low power state. If the computer 12 is in a low power state, then at 80 the audio alarm 16 is enabled. If the computer is not in a low power state, then at 82 the audio alarm is enabled and disabled as programmed in the UPS software program.

Software used with embodiments of the present invention can be stored on any type of a computer usable medium for storing data, such as, for example, but not limited
20 to, floppy disks, magnetic tape, zip disks, hard drives, CD-ROM, optical disks, or a combination of these. It should be understood that although the description above has described embodiments of the invention as having a single program, the program can easily be separated into more than one program and still be within the scope of the

invention. Also, the methods of the programs can be completed either through software, firmware or hardware.

Rather than or in addition using computer software to disable the UPS audio alarm, the UPS can have a programmable interface on it such that a user can program the 5 time periods during which the UPS audio alarm will be enabled and/or disabled.

Additionally or alternatively, the UPS 14 can be connected to a computer network and send an e-mail to one or more predetermined people to notify them of a

predetermined event if the audio alarm is disabled. Such a system is disclosed in the application entitled Power Supply Event Notification System, which was filed with the

10 U.S. Patent and Trademark Office on March 20, 2001, has Serial No. 09/812,665 and is hereby incorporated by reference.

An advantage of embodiments of the present invention is when a UPS is used to provide backup power to a home computer system, the UPS can be programmed such that the audio alarm will not sound in the middle of the night. Another advantage of

15 embodiments of the invention is that when a UPS is used in a noise sensitive work environment, such as a meeting room, the UPS can be programmed such that the alarm will not sound during a meeting.

It should be also understood that although the description above has described 20 embodiments of the invention as used with a UPS 14, the invention is also applicable to other types of power supplies and other devices that are operated using batteries.

Having thus described at least one illustrative embodiment of the invention, various alterations, modifications and improvements will readily occur to those skilled in the art. Such alterations, modifications and improvements are intended to be within the

scope and spirit of the invention. Accordingly, the foregoing description is by way of example only and is not intended as limiting. The invention's limit is defined only in the following claims and the equivalents thereto.

What is claimed is:

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